CLAIMS

1. An apparatus for stitching together two or more stacked planar layers, said apparatus including:

a stitch head mounted at a fixed location and actuatable to insert a stitch through a stack of two or more planar layers located beneath said stitch head;

a substantially horizontally oriented bed for supporting said stack of planar layers for manually guided movement across said bed beneath said stitch head;

detector means for detecting movement of a surface of said stack proximate to said stitch head for producing signals representing the magnitude of stack surface movement; and

control circuit means responsive to said signals indicating stack surface movement exceeding a certain threshold for actuating said stitch head to insert a stitch through said stack.

2. The apparatus of claim 1 wherein said stitch head includes a needle mounted for reciprocal movement substantially perpendicular to said bed between a full up position and a full down position; and wherein

said control circuit means for actuating said stitch head includes means for applying power to said stitch head to cause said needle to traverse one cycle from said full up position to said full down position to said full up position.

3. The apparatus of claim 2 wherein said means for applying power includes a motor/brake assembly operable in a motor mode for moving said needle and a brake mode for stopping movement of said needle.

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4. The apparatus of claim 2 wherein said means for applying power includes a motor and a clutch/brake assembly; and wherein

said clutch/brake assembly is operable in a clutch mode for coupling said motor to said stitch head for moving said needle and a brake mode to stop movement of said needle.

5. The apparatus of claim 1 wherein said bed defines a flat substantially horizontal surface for supporting said stack of planar layers; and wherein

said stitch head includes a needle mounted for movement substantially perpendicular to said bed surface between a full up position and a full down position whereat it pierces said planar layers supported on said bed surface.

6. The apparatus of claim 5 wherein said control circuit means for actuating said head includes means for selectively applying power to said stitch head to cause said needle to move from said full up position to said full down position.

7. The apparatus of claim 6 further including means for returning said needle from said full down position to said full up position.

8. The apparatus of claim 1 wherein said detector means includes a light source for illuminating said stack surface; and

means for processing light reflected from said illuminated layer for determining the magnitude of movement of said stack surface.

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9. The apparatus of claim 1 wherein said detector means includes optical means for measuring movement of said stack surface along orthogonal X and Y axes; and

signal processing means responsive to said measured movement for determining the magnitude of resultant movement of said stack; and wherein

said control circuit means actuates said stitch head when the magnitude of said resultant movement exceeds a predetermined stitch length.

10. A machine for stitching at least one fabric layer, said machine comprising:

an upper arm and a lower arm mounted in vertically spaced substantially parallel relationship to define a throat space therebetween;

a substantially horizontally oriented plate on said lower arm for supporting said fabric layer for guided movement in said throat space;

a needle arm supported from said upper arm above said plate actuatable to insert a stitch into said fabric layer;

a detector for detecting movement of a surface of said fabric layer in said throat space; and

control circuitry responsive to detected movement of said fabric layer surface for controlling actuation of said needle arm.

11. The machine of claim 10 wherein said detector operates to produce X and Y signals respectively representing the magnitude of translational movement of said fabric layer surface along perpendicular X and Y axes.

12. The machine of claim 10 wherein said detector operates to detect movement of said fabric layer surface without physically contacting said fabric layer.

13. The machine of claim 10 wherein said detector includes:

a window oriented to collect energy from said fabric layer surface proximate to said plate; and

signal processing means responsive to energy collected by said window for producing signals representing the magnitude of movement of said fabric layer across said plate.

14. The machine of claim 13 wherein said detector includes a source of energy for illuminating said fabric layer surface to reflect energy into said window.

15. The machine of claim 14 wherein said source of energy comprises a light source and said window collects light images reflected from said fabric layer surface.

16. The machine of claim 13 wherein said produced signals represent translational movement of said fabric layer surface along perpendicular X and Y axes.

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17. The machine of claim 10 wherein said needle arm includes a needle mounted for cyclic movement between an up position spaced from said plate and a down position piercing said fabric layer proximate to said plate; and wherein

said control circuitry is actuatable for moving said needle through at least one cycle comprising needle motion from said up position to said down position to said up position.

18. The machine of claim 17 wherein said control circuitry includes a needle drive means for moving said needle through a cyclic movement in response to a certain magnitude of fabric layer movement detected by said detector.

19. The machine of claim 18 further including user means for adjusting the value of said certain magnitude.

20. The machine of claim 17 wherein said control circuitry includes a needle drive means for repeatedly cyclically moving said needle at a rate related to the speed of fabric layer surface movement detected by said detector.

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21. A quilting apparatus for inserting stitches of uniform length through a stack of one or more fabric layers, said apparatus comprising:

a stitch head;

a bed defining a substantially horizontally oriented planar surface mounted opposite to said stitch head, said planar surface being configured to support said stack for guided movement across said planar surface;

said stitch head including a needle operable to execute a cyclic movement from an up position remote from said planar surface to a down position piercing said stack on said planar surface, and back to said up position;

a detector defining a window for collecting energy from a target area substantially coincident with a surface of said stack; and

signal processing means responsive to said collected energy for indicating the magnitude of stack translational movement across said planar surface; and

control means responsive to a translational movement of said stack of a magnitude exceeding a certain threshold for causing said needle to execute said cyclic movement.

22. The quilting apparatus of claim 21 wherein said detector includes:

a light source mounted to illuminate said stack surface in said target area; and wherein

said window is oriented to collect light images reflected from said target area.

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23. A method of forming successive stitches of uniform length through a stack of fabric layers having top and bottom surfaces, said method comprising:

mounting an actuatable stitch head at a fixed location;

manually moving said stack of fabric layers across a horizontal planar surface under said stitch head;

detecting the movement of at least one of said stack surfaces proximate to said stitch head; and

actuating said stitch head in response to a certain magnitude of detected stack movement to insert a stitch through said stack of fabric layers.

24. The method of claim 23 wherein said step of mounting said stitch head includes mounting a needle for cyclic vertical movement between an up position spaced from said stack and a down position penetrating said stack moving across said planar surface.

25. The method of claim 23 wherein said step of detecting the movement of said stack includes:

providing an energy source for illuminating a target area of a surface of said stack;

collecting energy images reflected from said target area; and

processing said collected energy images to determine the magnitude of movement of said stack.

26. The method of claim 23 wherein said step of actuating said stitch head includes moving said needle through a single cyclic movement in response to each increment of stack movement greater than said certain magnitude.

27. The method of claim 23 wherein said step of actuating said stitch head includes repeatedly cyclically moving said needle at a rate related to the speed of stack movement.

28. A method of forming successive stitches of uniform length through a stack of one or more fabric layers having top and bottom surfaces, said method comprising:

providing a horizontally oriented planar surface for supporting said stack for guided movement across said planar surface;

mounting a stitch head opposite to said planar surface where said stitch head is selectively actuatable to insert a stitch through said stack layers;

manually moving said stack across said planar surface;

optically observing a target area coincident with one of said stack surfaces to determine the magnitude of stack movement proximate to said planar surface; and

responding to a magnitude of movement greater than a certain threshold for actuating said stitch head to insert a stitch into said stack.

29. The method of claim 28 wherein said step of moving said stack comprises a user manually grasping said fabric layers to push/pull said stack across said planar surface.

30. The method of claim 28 wherein said stack is mounted on a frame; and wherein

said step of moving said stack comprises a user manually grasping said frame to push/pull said stack across said planar surface.

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31. A quilting apparatus for inserting stitches into a stack of one or more fabric layers, said apparatus comprising:

a stitch head;

a bed defining a substantially horizontally oriented planar surface mounted opposite to said stitch head, said planar surface being configured to support said stack for guided movement of said stack across said planar surface;

said stitch head including a needle operable to insert a stitch into said stack by executing a cyclic movement including a needle-up position remote from said planar surface and a needle-down position piercing said stack proximate to said planar surface;

a detector for measuring the movement of said stack across said planar surface proximate to said stitch head; and

control means for causing said needle to execute cyclic movements at a rate substantially proportional to the rate of stack movement measured by said detector.

32. The apparatus of claim 31 wherein said detector operates to measure the magnitude of translational movement of said stack along orthogonal directions.

33. The apparatus of claim 32 wherein said control means causes said needle to execute one cyclic movement for each threshold unit of movement measured by said detector.

34. The apparatus of claim 31 wherein said stack of fabric layers includes an exterior stack surface; and wherein

said detector measures stack movement by measuring translational movement of said exterior stack surface.

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